

CLAIMS

What is claimed is:

1. A method for heat treating a homogenized fluid product, the method comprising the steps of:  
  
    feeding a stream of fluid product ingredients under pressure through a local constriction of flow to effectuate high shear mixing of the fluid product ingredients in a high shear mixing zone downstream from the local constriction of flow and thereby form a homogenized fluid product at a first temperature; and  
  
    introducing a sufficient amount of the homogenized fluid product at a second temperature, which is less than the first temperature, into the high shear mixing zone to effectuate mixing of the homogenized fluid product at the first temperature with the homogenized fluid product at the second temperature to thereby heat treat the homogenized fluid product fluid product.
2. The method of claim 1 wherein the homogenized fluid product is selected from the group consisting of a pure liquid product, emulsion, suspensions, and liquid-gas dispersions.
3. The method of claim 1 wherein the second temperature is at least about 1 °C less than the first temperature.
4. The method of claim 1 wherein the second temperature is at least about 10 °C less than the first temperature.
5. The method of claim 1 wherein the second temperature is at least about 1 % less than the first temperature.
6. The method of claim 1 further comprising the step of pre-mixing the fluid product ingredients prior to the feeding step.

7. The method of claim 1 wherein the homogenized fluid product at the first temperature has a concentration that is substantially equal to the concentration of the fluid product at the second temperature.
8. The method of claim 1 wherein the homogenized fluid product at the second temperature is supplied to the high shear mixing zone from a separate source of the homogenized fluid product at the second temperature.
9. A method for heat treating a homogenized fluid product, the method comprising the steps of:
  - feeding at least one stream of fluid product ingredients through a local constriction of flow to effectuate high shear mixing of the fluid product ingredients in a high shear mixing zone downstream from the local constriction of flow and thereby form a homogenized fluid product;
  - cooling at least a portion of the homogenized fluid product to thereby form a cooled homogenized fluid product; and
  - introducing the cooled homogenized fluid product into the high shear mixing zone to effectuate mixing of the homogenized fluid product with the cooled homogenized fluid product and heat treat the homogenized fluid product.
10. The method of claim 9 wherein the stream of fluid product ingredients includes a temperature sensitive material.
11. The method of claim 10 wherein the temperature sensitive material is selected from the group consisting of biological materials, organic materials, pharmaceutical materials, cellular materials, tissue materials, microbial materials, plant extracts, animal extracts, and certain food materials.

12. The method of claim 9 wherein the cooling step includes passing the portion of the homogenized fluid product through a cooling device to effectuate cooling of the homogenized fluid product.
13. The method of claim 9 wherein the temperature difference between the homogenized fluid product and the cooled homogenized fluid product is at least about 1 °C.
14. A method for heat treating a homogenized fluid product, the method comprising the steps of:
  - mixing a homogenized fluid product and a cooling fluid in a flow-through channel downstream from a local constriction of flow provided in the flow-through channel to heat treat the homogenized fluid product, wherein the homogenized fluid product and the cooling fluid are substantially equal in composition.
15. The method of claim 14 further comprising the step of passing a stream of fluid product ingredients through the local constriction of flow to effectuate high shear mixing of the fluid product ingredients and thereby form the homogenized fluid product.
16. The method of claim 14 wherein the homogenized fluid product has a concentration that is substantially equal to the concentration of the cooling fluid.
17. The method of claim 14 wherein the mixing of the homogenized fluid product and the cooling fluid in the flow-through channel occurs at a sufficient distance downstream from the local constriction of flow to prevent damage to any temperature sensitive materials present in the homogenized fluid product.

18. A method for heat treating a fluid product, the method comprising the steps of:
  - introducing at least two streams of fluid components into a passageway for impingement mixing thereof to thereby form a homogenized fluid product at a first temperature; and
  - introducing a sufficient amount of the homogenized fluid product at a second temperature into the passageway to effectuate mixing of the homogenized fluid product at the first temperature with the homogenized fluid product at the second temperature to thereby heat treat the homogenized fluid product, wherein the second temperature is less than the first temperature.
19. A method for heat treating a homogenized fluid product, the method comprising the steps of:
  - introducing at least two streams of homogenized fluid product into a passageway for impingement mixing thereof, wherein the temperature of one of the streams is substantially less than the temperature of the other stream to thereby heat treat the homogenized fluid product.
20. A system for heat treating a homogenized fluid product comprising:
  - a high shear mixing device including:
    - a flow-through channel defined by at least one wall and having an outlet, a local constriction of flow provided therein, and a port provided in the wall downstream from the local constriction of flow providing fluid communication with the flow-through channel, the local constriction of flow configured to permit passage of fluid product ingredients therethrough to effectuate high shear mixing of the fluid product ingredients and thereby form a homogenized fluid product;
    - a cooling device fluidly coupled to the port in the high shear mixing device and configured to cool at least a portion of the homogenized fluid product; and

a valve mechanism fluidly coupled between the outlet of the flow-through channel and the cooling device, the valve mechanism configured to direct at least a portion of the homogenized fluid product to the cooling device.

21. The system of claim 20 further comprising a first pump fluidly coupled between the cooling mechanism and the high shear mixing device to supply cooled fluid product to the flow-through channel through the port.
22. The system of claim 21 further comprising a second pump to supply the fluid product ingredients to the high shear mixing device.
23. The system of claim 20 wherein the device is a homogenizer.
24. The system of claim 20 wherein the device is a static mixer.
25. The system of claim 20 wherein the device is a flow reactor.